CLAIMS

1. Method of decoding information by turbocoding of source information, the coded information being represented by a set of initial weighted values, the method comprising a finite sequence of iterations;

5   each iteration proceeding with an identical cycle of complete decoding of the information coded by means of a set of elementary decoding operations concatenated in parallel or in series separated by deinterleaving and/or interleaving steps;

each elementary decoding operation receiving a first item of information to be decoded representing by a set of weighted input values and at least one auxiliary item

10   of information for increasing the reliability of the said first item of information, the said elementary decoding operation generating an item of elementary decoded information represented by a set of output weighted values and an item of auxiliary information for increasing the reliability of a second item of information to be decoded;

15   characterised in that at least the last iteration of the said sequence is followed by at least one hard decision operation supplying a first item of output information from the item of elementary decoded information from at least one elementary decoding operation of the said last iteration;

and in that the method comprises at least one error detection operation for the

20   said first item of output information and, in the event of error:

the first item of output information or a second item of output information, obtained by hard decision from the elementary decoded information from at least one elementary decoding operation of the said last iteration, is re-encoded and then converted into a set of weighted values;

25   the said weighted values are combined with the initial weighted values or with the input weighted values of an elementary decoding operation of the first iteration in order to supply modified initial weighted values or modified input weighted values;

the sequence of iterations is repeated using the said modified values.

30   2. Decoding method according to Claim 1, characterised in that

the first item of output information is turbodecoded information obtained from at least one end elementary decoding operation of the said last iteration.

3. Decoding method according to Claim 2, characterised in that, in the event of error on the turbodecoded information:

the first item of output information is turbocoded according to the said turbocoding and then converted into weighted values;

the said weighted values are combined with the initial weighted values.

4. Decoding method according to Claim 2, characterised in that the second item of output information is obtained by a plurality of hard decision operations, each operating on the elementary decoded information from an elementary decoding operation of the said last iteration and supplying an item of output elementary information;

and, in the event of error on the turbodecoded information:

each item of output elementary information is re-encoded and then converted into a set of weighted values;

the said weighted values are combined with the initial weighted values.

5. Decoding method according to Claim 2, characterised in that the second item of output information is obtained by a plurality of hard decision operations, each operating on the elementary decoded information from an elementary decoding operation of the said last iteration and supplying an item of output elementary information;

and, in the event of error on the turbodecoded information:

each item of output elementary information is re-encoded and then converted into a set of weighted values;

the said weighted values issuing from an elementary decoding operation of the said last iteration are combined with the input weighted values of the corresponding elementary decoding operation of the first iteration.

6. Decoding method according to Claim 1, characterised in that the first item of output information is obtained by a plurality of hard decision operations, each

operating on the elementary decoded information from an elementary decoding operation of the last iteration and supplying an output elementary information item;

each output elementary information item is subjected to an error detection operation;

5 each erroneous output elementary information item is re-encoded and then converted into a set of weighted values;

the said weighted values are combined with the initial weighted values.

7. Decoding method according to Claim 1, characterised in that the first output
10 information item is obtained by a plurality of hard decision operations, each operating on the elementary decoded information item from an elementary decoding operation of the said last iteration and supplying an output elementary information item;

each output elementary information item is subjected to an error detection operation;

15 each erroneous output elementary information item is re-encoded and then transformed into a set of weighted values;

the said weighted values issuing from an elementary decoding operation of the said last iteration are combined with the input weighted values of the corresponding elementary decoding operation of the first iteration.

20

8. Decoding method according to one of Claims 4 to 7, characterised in that, the source information having been coded by a turbocoding with parallel concatenation of elementary coding operations associated with interleaving steps,

each iteration comprises a set of elementary decoding operations concatenated
25 in parallel, each elementary decoding operation corresponding to an elementary coding operation and being associated with an interleaving or deinterleaving step;

each elementary decoding operation of an iteration supplies a reliability auxiliary information item to at least one distinct elementary decoding operation of the following iteration.

30

9. Decoding method according to Claims 8 and 4 or 8 and 6, characterised in that the re-encoding of the output information is the said turbocoding.

10. Decoding method according to Claims 8 and 5 or 8 and 7, characterised in that the re-encoding of an output elementary information item is effected by means of an elementary coding operation corresponding to the elementary decoding operation from which the output elementary information came.

5

11. Decoding method according to one of Claims 4 to 7, characterised in that, the source information having been coded by a turbocoding with parallel concatenation of elementary coding operations associated with interleaving steps,

each iteration comprises a set of elementary decoding operations concatenated

10   in series, each elementary decoding operation corresponding to an elementary coding operation;

each elementary decoding operation of an iteration supplies a reliability auxiliary information item to at least one elementary decoding operation of the same iteration or the following iteration.

15

12. Decoding method according to Claims 11 and 4 or 11 and 6, characterised in that the re-encoding of the output information is the said turbocoding.

13. Decoding method according to Claims 11 and 5 or 11 and 7, characterised

20   in that the re-encoding of an elementary output information item is effected by means of an elementary coding operation corresponding to the elementary decoding operation from which the elementary output information item came.

14. Decoding method according to one of Claims 8 to 13, characterised in that,

25   the source information having been coded by a turbocoding with parallel concatenation of elementary coding operations of the recursive systematic type,

each elementary decoding operation of an iteration supplies an extrinsic information item as reliability auxiliary information, an increase in reliability brought by the said elementary operation to the estimation of the systematic information.

30

15. Decoding method according to one of Claims 4 to 7, characterised in that, the source information having been coded by a turbocoding with serial concatenation of elementary coding operations separated by interleaving steps,

each iteration comprises a set of elementary decoding operations concatenated in series, each elementary decoding operation corresponding to an elementary coding operation;

5   two elementary decoding operations with consecutive ranks in the same iteration being separated by a deinterleaving step and two elementary decoding operations of consecutive ranks in two consecutive iterations being separated by an interleaving step;

each elementary decoding operation of an iteration supplies a reliability auxiliary information item to the decoding operation with the preceding rank in the

10   following iteration.

16. Decoding method according to Claims 15 and 5 or 15 and 7, characterised in that the re-encoding of an output elementary information item is effected by means of a series of elementary coding operation corresponding to the series of elementary

15   decoding operations of the said last iteration from which the said output elementary information item came.

17. Decoding method according to Claims 15 and 5 or 15 and 7, characterised in that the re-encoding of an elementary output information item is effected by means

20   of an elementary coding operation corresponding to the elementary decoding operation from which the elementary output information item came.

18. Decoding method according to one of Claims 15 to 17, characterised in that the elementary coding operations are of the recursive systematic type.

25

19. Decoding method according to Claim 6, characterised in that, the source information having been coded by a turbocoding produced by a plurality of elementary block coding operations,

each iteration comprises a set of elementary decoding operations concatenated

30   in series, each elementary decoding operation of a dimension corresponding to an elementary decoding operation of the same dimension;

each elementary decoding operation relating to a dimension supplies a reliability auxiliary information item to the following decoding operation relating to another dimension.

20.   Decoding method according to Claim 19, characterised in that the re-encoding of the output elementary information is the said turbocoding.

5   21.   Decoding method according to Claim 19, characterised in that the re-encoding of an output elementary information item is effected by an elementary coding operation corresponding to the elementary decoding operation from which the said output elementary information item came.

10   22.   Decoding method according to one of Claims 19 to 21, characterised in that the error detection is effected by a block code syndrome calculation.

23.   Decoding method according to one of Claims 1 to 21, characterised in that the error detection is effected by means of a CRC code.

15

24.   Decoding method according to Claim 14, characterised in that the error detection is effected using a statistical measurement of the extrinsic information from a plurality of elementary decoding operations.

20   25.   Decoding method according to one of the preceding claims, characterised in that the error detection is effected by measuring the convergence of the weighted output values from at least one elementary decoding operation for a plurality of successive iterations.

25   26.   Decoding method according to Claim 24, characterised in that the measurement of convergence is an entropic difference.

27.   Decoding method according to one of the preceding claims, characterised in that the weighted values are expressed as log likelihood values and in that the
30   combination operation consists of subtracting a fraction of the weighted values obtained by converting the first or second output information item to the initial values or to the weighted input values.

28. Decoding method according to Claim 27, characterised in that the fraction of the weighted values is obtained by multiplying them with adaptive coefficients which are a function of the type of turbocode and/or the signal to noise ratio and/or the type of transmission channel.

29. Decoding method according to one of the preceding claims, characterised in that each of the last iterations of the said sequence is followed by the said hard decision operation or the said plurality of hard decision operations, the said error detection operation or the said plurality of error detection operations, and the operation of combination with the initial weighted values or with input weighted values before the said sequence of iterations is repeated.

30. Decoding method according to Claim 29, characterised in that the said sequence is repeated as long as an error is detected.

31. Decoding method according to Claim 29, characterised in that the said sequence is repeated until a predetermined number of repetitions is reached.